Improvement in awareness levels and periodontal health among patients undergoing fixed orthodontic appliance therapy with established gingivitis and periodontal health maintenance program: A questionnaire based study.

Mejora de los niveles de conciencia y salud periodontal entre pacientes sometidos a terapia con aparatos de ortodoncia fijos con gingivitis establecida y programa de mantenimiento de la salud periodontal: Un estudio basado en cuestionarios.

Anupama Rao.[1]
Rajesh Hosadurga.[2]
Kumar Vijaya.[1]
Rajesh Kashyap Shankar.[1]
Vinita A Boloor.[1]
Shruthy Prathap.[1]

Affiliations:
[1]Department Of Periodontology, Yenepoya Dental College. Mangalore, Karnataka, India.
[2]Department Of Periodontology, Melaka-manipal Medical College. Melaka, Malaysia.

Corresponding author: Rajesh Hosadurga. Department of periodontics, Melaka-Manipal Medical College, Jalan Batu Hampar, Bukit Baru, 75150 Melaka, Malaysia. Phone: (606) 2896662. E-mail: drsharaj@gmail.com

Abstract: Objetive: Home oral care practices in patients undergoing orthodontic therapy are often ineffective in maintaining optimal plaque control. The aim of the present study was to assess the effectiveness of periodontal maintenance program in subjects with established gingivitis undergoing fixed orthodontic appliance therapy for one year. **Material and Methods:** Forty patients undergoing fixed orthodontic appliance therapy with established chronic gingivitis were recruited for the study. As a part of a periodontal maintenance program, a pre-validated structured questionnaire evaluating oral hygiene and periodontal health was administered at the baseline as well as at the end of the study. At the baseline Gingival Bleeding Index, Gingival Index, and Bonded Bracket Plaque Index scores were recorded, Scaling and polishing procedure was performed followed by a customised Oral Hygiene Advice (OHA) session was conducted for all the study subjects. Clinical indices were assessed and OHA was conducted at the 3rd, 6th, 9th, and 12th months of orthodontic treatment visits. **Results:** There was significant improvement in the clinical indices and awareness regarding oral hygiene and periodontal health level in the patients at the end of the 12th month. **Conclusion:** The periodontal maintenance program appeared to be effective in improving the periodontal health and awareness health awareness level about oral hygiene among patients undergoing fixed orthodontic therapy at the end of 12 months in our study population.

Keywords: Oral Hygiene; Gingivitis; Surveys and Questionnaires; Dental Care; Orthodontic Appliances; Toothbrushing.

Resumen: Objetivo: Las prácticas de cuidado bucal en el hogar en pacientes sometidos a terapia de ortodoncia suelen ser ineficaces para mantener un control óptimo de la placa. El objetivo del presente estudio fue evaluar la efectividad del programa de mantenimiento periodontal en sujetos con gingivitis establecida sometidos a terapia con aparatos de ortodoncia fijos durante un año. **Material y Métodos:** Se reclutó para el estudio a 40 pacientes

sometidos a terapia con aparatos de ortodoncia fijos y con gingivitis crónica establecida. Como parte de un programa de mantenimiento periodontal, se administró un cuestionario estructurado pre-validado que evaluaba la higiene bucal y la salud periodontal al inicio y al final del estudio. En la línea de base, se registraron las puntuaciones del índice de sangrado gingival, el índice gingival y el índice de placa de soporte adherido, se realizó el procedimiento de raspado y pulido seguido de una sesión personalizada de consejos de higiene oral (CHO) para todos los sujetos del estudio. Se evaluaron los índices clínicos y se llevó a cabo la CHO a los 3, 6, 9 y 12 meses durante las visitas de tratamiento de ortodoncia. **Resultados:** Hubo una mejora significativa en los índices clínicos y la conciencia sobre la higiene oral y el nivel de salud periodontal en los pacientes al final del 12° mes. **Conclusión:** El programa de mantenimiento periodontal pareció ser eficaz para mejorar la salud periodontal y el nivel de conciencia de la salud sobre la higiene bucal entre los pacientes sometidos a terapia de ortodoncia fija al final de los 12 meses en nuestra población de estudio.

Palabra Clave: Higiene Bucal; Gingivitis; Encuestas y Cuestionarios; Atención Odontológica; Aparatos Ortodóncicos; Cepillado Dental.

INTRODUCTION.

Orthodontic treatment brings about remarkable changes in subjects with malocclusion and enhances quality of life.[1] However there are risks associated with orthodontic therapy. Failing to identify the risks associated with orthodontic treatment and not addressing them in the treatment plan can cause unhappiness among patients and sometimes even lawsuits.[2] Orthodontic treatment carries the risk of causing periodontal damage, pain, root resorption, temporomandibular disorders, caries, speech problems and enamel damage.[3] Multibracket bonded orthodontic appliances make oral hygiene maintenance difficult.[4] Orthodontic treatment can affect the periodontium by facilitating gingivitis, gingival overgrowth, and gingival recession.[3]

Some authors have reported that gingival changes occurring during orthodontic treatment are temporary and may not lead to irreversible clinical attachment loss.[5] Others have reported that clinical attachment loss increased significantly during orthodontic therapy.[6] Other studies have reported that orthodontic treatment does not cause harmful effects to the periodontium if good oral hygiene is maintained during orthodontic treatment.[7-10]

Increased colonization by anaerobic organisms leads to gingivitis and subsequent progression to perio-dontitis.[11] A polymerase chain reaction (PCR) based study indicated that local changes that occur due to the presence of fixed orthodontic appliances can affect the prevalence of periodontal pathogens in subgingival dental plaque.[11]

Increased plaque retention in patients might be due to lack of knowledge of oral hygiene or increased complexity due to the presence of bands, wires and ligatures.[7] Poor oral hygiene increases the risk of periodontal problems during orthodontic therapy.[11] Studies have reported that there is a rapid decline in oral hygiene compliance after the initial bonding phase during fixed orthodontic treatment.[12] Patient compliance for optimal oral hygiene requires systematic approach with clear and concise instructions by the dentists, proper tools for com-munication and patient motivation.[13,14] A systematic review has shown that rather than conventional mode of health education which focuses on disseminating information and rendering standard advice, motivational approaches may be more useful to achieve be-havioural changes.[15]

A study which evaluated the effects of structured follow-up communication after orthodontic appliance application reported that their follow-up procedure was an effective tool to increase oral hygiene compliance for a short period.[12] A systematic review recommended that more studies are required in order to recommend one-to-one oral hygiene advice (OHA) method to be effec-tive in improving oral health.[16] Hence, the aim of the present study was to assess the effectiveness of periodontal maintenance program in improvement of oral hygiene maintenance as measured by gingival bleeding index (GBI),[17] gingival index (GI)[18] and bonded bracket plaque index (BBPI)[19] in subjects with established gingivitis and undergoing fixed orthodontic appliance therapy.

MATERIALS AND METHODS.

Source of data

A total of 40 subjects within the age group of 18-35 years who were undergoing fixed orthodontic therapy and referred to the outpatient Department of Periodontology, Yenepoya Dental College, Mangalore participated in the study from January 2014-March 2017. Based on previous studies, and null hypothesis, a sample size of 60, at 90% power and 95% confidence interval was estimated.

A 10% drop out rate was estimated and adjusted in the sample size. Purposive sampling was used. Hence 60 patients who fulfilled the inclusion criteria were recruited for the study. This study will help us estimate sample size in conducting a randomized control to test if the standardized periodontal maintenance protocol used here is effective.

The inclusion criteria for the study were: Age ≥18 years, minimum of 20 teeth, good general health, patients undergoing fixed orthodontic treatment involving full upper and lower arch fixed appliance at least for next one year and with minimum of 20 scorable permanent teeth with established gingivitis (established gingivitis - a mean Gingival Index (G-Index) ≥1). GBI was defined as the percentage of sites with G-Index ≥2.[17,18] Exclusion criteria included:

1) Subjects with compromised manual dexterity

2) Subjects using electromechanical toothbrush.

3) Subjects with chronic and aggressive periodontitis (Community Periodontal Index of Treatment Needs [CPITN] code 4 teeth)

4) History of antibiotics and anti-inflammatory drugs intake in the preceding six months, drug allergy, systemic diseases, pregnancy, lactation, or on steroidal therapy

5) Subjects who smoked or chewed tobacco, or had alcohol intake

6) allergy to toothpaste.[20,21] The study period had a duration of one-year. The patients who met the inclusion and exclusion criteria were recruited to the study.

Ethical considerations

Ethical clearance was obtained from Yenepoya University Ethical Committee, (YUEC/2013/111) prior to commencement of the study. All subjects were examined by a single clinical examiner. Informed consent was obtained prior to the study from all the participating patients.

Study procedure

A standard periodontal maintenance protocol was established and followed for the recruited patients. The protocol comprised of:

a) Recording a brief case history and assessing baseline awareness level towards oral hygiene habits using a structured pre-test questionnaire

b) Assessment of oral hygiene using GBI[16], GI[17] and BBPI[18] indices,

c) Scaling and polishing done only at baseline.

d) One to one oral hygiene advice sessions (OHA) sessions using a PowerPoint presentation and take away printed handouts.

e) The recording of all clinical parameters followed by OHA was repeated at the 3rd, 6th, 9th, and 12th month

f) The post-test questionnaire was administered only at the 12th month.

The clinical examination for all the patients who were recruited to the study. were recorded by a pre-calibrated single examiner (AR).

Questionnaire preparation

A combination of open and close-ended structured questions were prepared in English and translated into Kannada and Malayalam with the help of translators. It was validated by two members of the validation panel at Yenepoya University. The questionnaire assessed awareness of oral hygiene habits (Q3-13) and risk factors for periodontal disease (Q14-21). The demographic data was recorded (Q1-2) (Appendix-1). This questionnaire was essential to understand awareness in order to motivate and educate the recruited patients. A score of 1 was given for right answers and a score of 0 for wrong answers. The scores were tabulated. The printed questionnaire was administered to the patients by another examiner (KVK) at the baseline (pre-test) and at the 12th month (post-test). The questionnaire form consisted of the following sections (refer Appendix-1)

- Section 1 - Demographic data

- Section 2 - Self reported oral hygiene habits

- Section 3 - Awareness of risk factors for gum disease

Oral hygiene advice Sessions (OHA)

Oral hygiene advice was given in a dental education clinic of the institute by another examiner (VAB) at baseline, 3rd, 6th, 9th and 12th month. The OHA session of 15-20 minutes included a lecture using Microsoft Powerpoint presentation using a projector and distribution of hand held pamphlets with printed material which mainly emphasised the role of oral hygiene maintenance throughout the orthodontic therapy.

The content included information on the importance

of plaque and oral hygiene maintenance during periodontal therapy, known risk factors and its role in progression of periodontal disease and impact of periodontal disease on well-known systemic diseases.

Patients were handed an oral hygiene kit consisting of an American Dental Association approved STIM® 42 Orthodontic toothbrush, a soft bristled orthodontic toothbrush (Global Dent Aids Pvt. Ltd, India) and Colgate® toothpaste (Colgate-Palmolive Pvt. Ltd, India. 200g) throughout the study period for brushing the teeth. Modified bass brushing technique was demonstrated on an acrylic model to ensure standardization. Subjects were advised to brush teeth for two minutes (30sec/quadrant), twice *per* day, with the orthodontic brush and the toothpaste provided.

Disclosing solution (two-tone dye solution) was used to demonstrate plaque in front of a mirror and in addition to tooth-brushing, patients were shown the correct usage of interdental aids like dental floss and a floss threader to remove plaque in and around the bracket. Rinsing with a 0.05% sodium fluoride mouth rinse twice daily after brushing the teeth was recommended. These were not included in the kit. Patients bought on their own and carried with them at every follow-up visit.

Statistical analysis

All the data was tabulated using Microsoft Excel sheet. The results were analysed using IBM Statistical Program for Social Sciences IBM® SPSS® Statistics V22.0 (SPSS Inc., Chicago Illinois, USA). Item wise analysis of questions regarding awareness of oral hygiene practices, risk factor assessment was done by Wilcoxon signed rank test. Mean, standard deviation (SD) and percentage were used for descriptive statistics. Mean change scores of GBI, GI, and BBPI were analysed by repeated measures ANOVA. Mean, SD, CI and F value were tabulated.

The Bonferroni correction was done to adjust probability *p*-values to avoid the increased risk of type I error, when making multiple comparisons. Pearson correlation coefficient was used to evaluate correlation between knowledge score before and after, GBI, GI, and BBPI scores at baseline and 12th months.

40 patients completed the study period of 12 months. Most of the dropout was noticed between 6th and 9th month of the study. The reasons for drop-out were that the majority of patients graduated university and moved out of the place or those who were working got transferred else where or due to financial reasons..

RESULTS.

Mean age of the patients was 22.68 (2.20) years (Table 1); 65% were females. At baseline (Table 2) 92.5% participants used manual orthodontic toothbrush; 52.5% used soft toothbrush and 45% brushed twice a day. Only 20% kept the brush at the gingival margin while brushing, 55% used fluoridated dentifrice and 25% used interdental aids which are crucial in plaque control. Majority avoided using dental aids like toothpicks which can cause traumatic injuries to the gingiva during orthodontic treatment.

At baseline, the awareness about periodontal impli-cations was very low (Table 2). Only 12.5% visited periodontists. Knowledge about risk factors like stress, smoking, genetics for periodon-tal disease was quite low. However, there was a significant change in the oral hygiene aware-ness at the end of 12th months. (Table 2 and Table 3).

Majority had the awareness about the orthodontic soft bristled brush before orthodontic treatment. At the end of 12th months there was significant improvement in brushing technique. The awareness about risk factors for periodontal disease increased significantly at the end of 12th months (Table 4).

Mean awareness scores at pre-test was 5.75±2.181 and a significant change to 17.45±0.639 was observed at the end of 12th month.

Tabla 1. Sociodemographic characteristics.

Demographics		Mean (SD)
Age		22.68 (2.20)
Gender (%)	Male	14 (35%)
	Female	26 (65%)

Tabla 2. Change in awareness pre and post- test assessment (%).

	Pre-assessment N(%)	Post -assessment N(%)	*p*-value
Do you brush your teeth? Yes	40 (100)	40 (100)	1.000
If yes, what type of toothbrush do you use? Manual ortho brush	37 (92.5)	40 (100)	0.083
If manual regular, what type of manual toothbrush do you use? Soft	21 (52.5)	38 (95)	0.000***
If yes, how many times do you brush your teeth? Two times	18 (45)	40 (100)	0.000***
Use of fluoridated toothpaste for tooth brushing? Yes	22 (55)	35(87.5)	0.001***
Keeping the brush at gum margin while brushing your teeth? Yes	8 (20)	40 (100)	0.000***
Daily use dental floss/Interdental brush/Unitufted brush along with tooth brush? No	10 (25)	38 (95)	0.000***
Use a toothpick to remove food particles stuck between bracket /teeth? No	8 (20)	40 (100)	0.000***
For bleeding gums, you should visit a: Periodontist	9 (22.5)	40 (100)	0.000***
Do you visit a Periodontist regularly during your orthodontic treatment? Yes	5 (12.5)	40 (100)	0.000***
The following is a major cause for gum disease: Bacterial plaque	35 (87.5)	40 (100)	0.000***
Regular tooth brushing is enough to control gum disease. No	8 (20)	36 (90)	0.000***
Food impaction between the teeth can result in gum problems. Yes	5 (12.5)	37 (92.5)	0.000***
Genes play a role in gum diseases. Yes	5 (12.5)	37 (92.5)	0.000***
Smoking cigarettes can be a risk factor to develop gum disease. Yes	18 (45)	40 (100)	0.000***
Uncontrolled diabetes can be a risk factor for gum disease. Yes	4 (10)	40 (100)	0.000 ***
Increased stress can cause harm to your gums. Yes	2 (10)	40 (100)	0.000***
Presence of gum disease has impact on systemic health. Yes	2 (10)	40 (100)	0.000***

‡: Wilcoxon signed rank test.   *****p-value<0.05:** Is considered statistically significant. ** Significant. ***: Highly significant.

Tabla 3. Comparison of mean change scores of awareness level pre-test and post-test.

Mean	Mean %	Wilcoxon signed rank test	*p*-value
Pre-test score	5.75 ± 2.181	31.9	0.000***
Post-test score	17.45 ± 0.639	96.9	

‡: Wilcoxon signed rank test. *****p-value<0.05:** Is considered statistically significt. ****p-value<0.01:** Significant. *****p-value<0.01:** Highly significant.

Tabla 4. Comparison of mean of GBI, GI and BBPI at baseline, 3rd month, 6th month, 9th month and 12th month.

Parameter		N	Mean (SD)	95% Confidence Interval for Mean		p-value
				Lower bound	Upper bound	
GBI	0 day	40	76.80 (9.28)	73.83	79.77	0.000***
	3rd mon	40	27.53 (5.71)	25.70	29.35	
	6th mon	40	27.55 (5.93)	25.65	29.45	
	9th mon	40	27.55 (5.94)	25.65	29.45	
	12th mon	40	27.53 (6.16)	25.76	29.69	
GI	0 day	40	2.14 (0.46)	1.99	2.99	0.000***
	3rd mon	40	0.51 (0.14)	0.47	0.56	
	6th mon	40	0.49 (0.13)	0.45	0.53	
	9th mon	40	0.49 (0.12)	0.45	0.53	
	12th mon	40	0.48 (0.13)	0.44	0.52	
BBPI	0 day	40	1.84 (0.29)	1.75	1.94	0.000***
	3rd mon	40	0.74 (0.28)	0.65	0.83	
	6th mon	40	0.69 (0.28)	0.60	0.78	
	9th mon	40	067 (0.26)	0.59	0.76	
	12th mon	40	0.66 (0.26)	0.58	0.75	

‡: Wilcoxon signed rank test. *p-value<0.05:** Is considered statistically significant. ** Significant. ***: Highly significant.

Tabla 5. Comparison of mean of GBI, GI and BBPI at baseline, 3rd month, 6th month, 9th month and 12th month.

Parameter					Mean difference	SD	p-value
	0 day	-	3rd mon		49.317	10.024	.000***
	0 day	-	6th mon		49.244	10.754	.000***
	0 day	-	9th mon		49.195	10.021	.000***
	0 day	-	12th mon		49.098	10.397	.000***
GBI	3rd mon	-	6th mon		-.073	3.744	1.000
	3rd mon	-	9th mon		-.122	3.689	1.000
	3rd mon	-	12th mon		-.220	3.921	1.000
	6th mon	-	9th mon		-.049	2.190	1.000
	6th mon	-	12th mon		-.146	2.623	1.000
	9th mon	-	12th mon		-.098	2.897	1.000
	0 day	-	3rd mon		1.628	.419	.000***
	0 day	-	6th mon		1.653	.412	.000***
	0 day	-	9th mon		1.648	.418	.000***
	0 day	-	12th mon		1.661	.415	.000***
GI	3rd mon	-	6th mon		.025	.042	.007***
	3rd mon	-	9th mon		.020	.033	.005***
	3rd mon	-	12th mon		.033	.034	.000***
	3rd mon	-	12th mon		-.005	.021	1.000
	6th mon	-	12th mon		.009	.017	.038**
	9th mon	-	12th mon		.014	.016	.000***
BBPI	0 day	-	3rd mon		1.108	.201	.000***
	0 day	-	6th mon		1.149	.201	.000***
	0 day	-	9th mon		1.171	.186	.000***
	0 day	-	12th mon		1.181	.183	.000***
	3rd mon	-	6th mon		.041	.047	.000***
	3rd mon	-	9th mon		.063	.061	.000***
	3rd mon	-	12th mon		.073	.061	.000***
	6th mon	-	9th mon		.022	.048	.062***
	6th mon	-	12th mon		.032	.056	.009***
	9th mon	-	12th mon		.010	.037	1.000

‡: Wilcoxon signed rank test. *p-value<0.05:** Is considered statistically significant. ** Significant. ***: Highly significant.

Tabla 6. Correlation between awareness scores
(pre-test, post-test) and change in GBI, GI and BBPI scores (baseline-12th month).

	Index score	Pearson correlation	*p*-value
Knowledge score before	GBI (baseline)	0.057	0.731
	GI (baseline)	0.020	0.903
	BBPI (baseline)	0.028	0.865
Knowledge score after	GBI 12th mon	0.198	0.228
	GI 12th mon	0.367	0.021**
	BBPI 12th mon	0.137	0.407

‡: Pearson correlation. **p*-value<0.05:* Is considered statistically signific. ****p*-value<0.01:* Significant. *****p*-value<0.01:* Highly significant.

APPENDIX-1. The questionnaire recorded the demographic data using questions (Q1-2), awareness of
oral hygiene habits (Q3-13) and risk factors for periodontal disease (Q14-21).

Instructions: This questionnaire is designed to check your mouth hygiene maintenance habits and awareness about factors that cause gum disease. All the data will be kept confidential and sections of this data will be used for research purposes only. There are no commercial interests involved in the study. Please make sure you have signed the consent form before you answer. This study has been approved by the institutional ethical committee of Yenepoya University for the purpose of research. If you have any queries you may request any of the dentists involved in the study. Dr. Anupama Rao, Dr. Vijay Kumar, Dr. Vinita Boloor or Dr. Sruthy Pratap. Kindly tick mark only one answer.

Demographic data:
1. Age
    A. 18-25
    B. 26 -35
2. Gender
    A. Male
    B. Female
    C. Other

Self-reported oral hygiene practices:
3. Do you brush your teeth?
    A. Yes
    B. No
4. If yes, what type of toothbrush do you use?
    A. Manual orthodontic brush
    B. Manual regular toothbrush
    C. Powered
    D. Not sure
    E. Any other
5. If manual, the best type of manual toothbrush that you use is?
    A. Soft
    B. Medium
    C. Hard
    D. Never noticed
6. If yes, how many times do you brush your teeth?
    A. Usually Twice
    B. Usually once
    C. Usually Thrice a day
    D. Occasional (No predictable pattern)
7. Do you use fluoridated toothpaste for tooth brushing?
    A. Yes
    B. No
    C. Never noticed
8. Do you use fluoride mouth rinse daily?
    A. Yes
    B. No
    C. Occasionally
9. Do you keep the brush at gum margin while brushing your teeth?
    A. Yes
    B. No
    C. Never noticed

10. Do you daily use dental floss/Interdental brush/Unitufted brush along with tooth brushing?	A. Yes B. No C. Occasionally
11. Do you use a toothpick to remove food particles stuck between the bracket /teeth?	A. No never B. Yes, sometimes C. Yes, always
12. Whom should you visit for bleeding gums?	A. Periodontist B. Orthodontist C. family doctor D. Any other
13. Do you visit a Periodontist regularly during your orthodontic treatment?	A. Yes B. No C. Sometimes D. Only when my gum start hurting
14. Which of the following is a major cause for gum disease? (If you want you can tick multiple answers for this Question)	A. Dental plaque B. Eating sticky, sugary diet C. Vitamin C deficiency D. Hereditary E. Any other
15. Is regular tooth brushing enough to control gum disease?	A. No B. Yes C. Not sure
16. Do you know food impaction between the teeth can result in gum problems?	A. Yes B. No C. Not sure
17. Do you think genes play a role in gum diseases?	A. Yes B. No C. Not sure
18. Do you think smoking cigarettes can be a risk to develop gum disease?	A. Yes B. No C. Not sure
19. Do you know uncontrolled diabetes can be a risk factor for gum disease?	A. Yes B. No C. Not sure
20. Do you know increased stress can cause harm to your gums?	A. Yes B. No C. Not sure
21. Do you know the presence of gum disease has an impact on systemic health?	A. Yes B. No C. Not sure

Table 4 shows the mean scores at baseline, 3rd months, 6th months, 9th months and 12th months in GBI, GI and BBPI scores. We found statistically significant reductions in GBI, GI and BBPI at 12th months.

The reduction remained highly significant after bonferroni correction (Table 5). However, correlation between knowledge, attitude and practice scores at baseline and 12th months and GBI, GI, or BBPI scores were not statistically significant. (Table 6)

DISCUSSION.

Maintaining good oral hygiene is an arduous task for patients undergoing fixed appliance orthodontic therapy. Post installation of multibracket appliances, the presence of bands wires and ligatures complicate oral hygiene practices. A robust periodontal maintenance program is necessary to maintain periodontal health during fixed orthodontic appliance therapy.[16] Hence, the aim of the present study was to assess the effectiveness of periodontal maintenance program as measured by GBI,[18] GI,[19] and BBPI[20] in subjects with established gingivitis undergoing fixed orthodontic appliance therapy.

In the present study, the baseline patient awareness about self-reported oral hygiene practices and risk factor assessment was poor. A customized, intensive OHA sessions were conducted at 3rd, 6th, 9th and 12th months of the study period. Their awareness of oral

hygiene practices and risk factor assessment im-proved significantly at the end of the study. The technique of tooth brushing, the frequency of brushing, and usage of interdental aids improved significantly.

The frequency of visits to periodontists increased, Knowledge about risk factors increased. A systematic review suggested that conventional oral health moti-vation procedures are less efficient.[15]

In this study we incorporated audio visual aids and written instructions as tools to improve awareness. Constant reinforcement was done at all the recall intervals of the study using one-to-one oral hygiene sessions. Improvement in awareness could be attributed to the one-to-one oral hygiene sessions that were carried out as a part of a standardized periodontal maintenance protocol. Similar results were seen in the study conducted by Bardal et al.,[22] However, their method of intervention was different from our study.

There was significant improvement in change scores of GBI, GI and BBPI indices between baseline and at the end of 12th months. Our study results were in agreement with the results of PAP Bardal et al.,[22] who investigated the effects of educational, preventive and motivational actions on the oral health of 25 patients undergoing fixed orthodontic treatment reported significant im-provement in oral health occurred in all indices at 6, 12, and 24 weeks. Lalik et al.,[23] found plaque removal efficacy was improved in paediatric patients undergoing orthodontic treatment with oral health counselling which resulted in reduction of gingival inflammation in their 6th month study period.These results were in contrast to studies that reported constant deterioration of oral hygiene after the initial bonding phase during fixed orthodontic treatment.[12] There was a difference in methodology yet our patients showed excellent levels of oral hygiene .

Many studies have reported that gingival recession, gingival enlargement and continued clinical attach-ment loss in periodontal therapy.[3] In our study all the participants showed reduction in gingivitis with no further progression to periodontitis. However, the periodontal disease is multifactorial in nature. It will be difficult to quantify the role of orthodontic treatment in development of periodontal problems.

There is a likelihood that there could be a subset of patients who may encounter many risk factors and end up with periodontal disease.[3]

Even though our study was longitudinal in nature, the dropout rate was on the higher side and sample size appears to be small. Higher dropout rates is one of the drawbacks of longitudinal studies. Hence, generalization cannot be done. We tried to assess if there was any association or correlation between improvement in the awareness scores with the improvement in the change scores of clinical indices used.

However, there was no significant correlation. To the best of our knowledge no study attempted to do this. The results could probably be attributed to variables like smaller sample size and purposive sampling. Hence the results of our study should be interpreted with caution. Mamai-Homata et al.,[24] in a group of Greek dental students investigated and confirmed the hypothesis that young women have better oral hygiene habits compared to men was confirmed. Our study had more female subjects. Maybe significant improvement in clinical indices scores and maintenance of excellent oral hygiene levels could be due to the aforementioned reason. However, this comparison was beyond the scope of the study.

Nevertheless, Bardal et al.,[22] concluded that health promotion and disease prevention should be part and parcel of the orthodontic care and oral health care guidance and motivation should be provided before and during the treatment period. Within the limitations of our study, we agree with the recommendations of the abovementioned study.

We followed up patients for a period of 12 months and good oral hygiene coupled with stable periodon-tium appears to be the strength of the study. The standardized periodontal maintenance program could have contributed to the significant improvement in clinical parameters and awareness level during the course of fixed orthodontic treatment.

Our study adds to the evidence that further multicentred, well-controlled randomised controlled trial with a control group using standard questionnaire needs to be conducted in patients undergoing fixed orthodontic treatment and having periodontal disease to validate the study findings.

CONCLUSION.

A standardized periodontal maintenance program in patients having established gingivitis and undergo-ing fixed periodontal therapy is beneficial in controlling the further progression of periodontal disease. Constant motivation, reinforcement and follow up during

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periodontal maintenance program offers significant clinical benefits.

Clinical relevance

Clinicians should be aware of the impact of periodontal maintenance protocol on the predictable out-come of fixed orthodontic therapy. Frequent patient visits for orthodontic treatment provide opportuni-ties to educate and motivate patients, or refer them to a periodontist to follow a standardized mainte-nance protocol before and after orthodontic treatment. This will ensure minimal detrimental effects of dental-plaque induced inflammation during fixed orthodontic treatment.

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